



# FIRE AND WEATHER

**SUBJECTS:** English/Language Arts, Science, Social Studies

**GRADES:** 4-8

**DURATION:** One class period of 40-60 minutes

**GROUP SIZE:** One class of 20-30 students

**SETTING:** Indoors

**KEY VOCABULARY:** Meteorology, wildland fire, weather symbol, firefighter

**ANTICIPATORY SET:** Today we are going to become amateur meteorologists. We will learn to read weather maps and will also discuss the tremendous impact the weather has on the wildfires that we see so often on the news.

**OBJECTIVES:** The students will be able to: 1) be familiar with some of the more common weather symbols; 2) understand the impact weather has on wildland fires.

**MATERIALS:** Question sheet, weather symbol information sheets, map of the United States, and a bell or other noisemaker for each group.



**BACKGROUND:** All of the Earth's weather comes from basically two sources, the sun and the moisture in the air. These two work together to form clouds, to make rain and thunderstorms, and to cause winds to blow.

The blanket of air around the Earth is the atmosphere. All of our weather happens in the bottom layer of the atmosphere. This bottom layer is called the troposphere and is six to ten miles thick. Meteorology is the study of the changes in temperature, air pressure, moisture, and wind direction in the troposphere.

An air mass is a large area of air that has similar temperature and moisture properties throughout. When two air masses come together, the line between them is called a front. Along a front there are usually clouds, rain, and sometimes thunderstorms. The movement of air masses assists in creating a variety of weather conditions.

Wildfires and weather are as interrelated as the prairie and the bison. Weather conditions can directly contribute to the occurrence of wildland fire through lightning strikes or indirectly through an extended dry spell contributing to the availability of fuel and a lower fuel moisture level. All these weather factors combined with a low dew point, which indicates the amount of moisture in the air, can lead to dangerous conditions for firefighters. Relative humidity can be inferred from dew point levels.

A large wildfire is often capable of modifying local weather conditions and can "produce its own weather". These larger fires can create their own winds, thus increasing their flow of oxygen. A really large fire can generate hurricane-force winds, up to 120 miles per hour. The high temperatures "preheat" the fuels in the fire's path, preparing them to burn more readily. When fires reach this stage, there is little firefighters can do. Nature is in charge. In the words of one fire behavior expert, "Large fires live to feed themselves."

These large, uncontrollable fires are usually in the more arid areas of the United States where rainfall averages are as low as 15 inches per year or less. In these areas the climate is naturally dry and dew points are usually quite low. When you combine drought conditions with all of

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these other naturally occurring factors it takes only a spark to ignite a fire.

Kentucky is not immune to wildfires. Even though our average annual rainfall ranges from 36 to 50 inches, Kentucky reports thousands of acres burned each year. In fact, for the past 10 years Kentucky has averaged 1,831 wildfires that burned 62,291 acres annually. Even though we have adequate rainfall there are specific times of the year (February 15-April 30 and October 1-December 15) that burning is unlawful within one hundred fifty feet of any woodland. In each of these seasons trees are (more or less) leafless and humidity is comparatively low. This allows the sun to dry fuels on the forest floor making them more susceptible to fire. The exception during these fire seasons is from 6:00 p.m. until 6:00 a.m. During these hours the winds normally die down and humidity rises. Unfortunately, the majority of fires in Kentucky are due to arson and carelessness and occur during these fire seasons.

The intensity of fires and the rate with which they spread is directly related to wind speed, temperature and relative humidity. Climate conditions such as long-term drought conditions also play a major role in the number and intensity of wildfires. Accurate and timely weather information is vital to plan and execute strategies to suppress wildfires. This is where the National Weather Service comes into play.

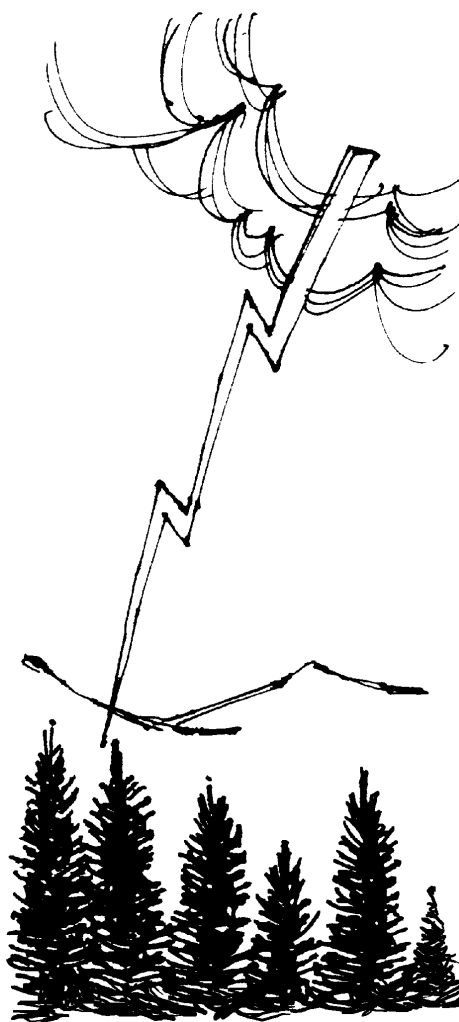
One branch of the National Weather Service is devoted to providing meteorological support to wildland fire management agencies. This support includes warnings, forecasts, on-site services during wildfires, and meteorological training for firefighters.

Maps are one of the tools used by meteorologists to interpret weather to firefighters as well as the general public. All of us have seen weather maps on national and local weather reports, on the Weather Channel, and in national and local newspapers. Have you ever noticed all of those squiggly and straight lines and other strange markings on these maps? These are special symbols and codes that explain the type of clouds, how much of the sky is covered by clouds, the type of precipitation that's falling, the temperature, the wind speed, the wind direction, and other important weather information. These symbols are used because they take up much less space than writing all this data on a map.

Meteorologists use official weather maps, an international code system, and station models that indicate all the weather data surrounding a particular area. The international code system enables other meteorologists to read and understand weather conditions throughout the world. This system can use more than 100 different symbols and codes. Most of us see only a few of these official symbols because weather maps for television and newspapers are simplified to help the layperson better understand what is happening with the weather.

In this lesson you and your students will use weather symbols to interpret a simplified weather map. You will also be determining which areas may be safe or unsafe to send firefighters into to suppress a wildland fire.

## PROCEDURE:



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1. The teacher will pass out copies of the two weather symbol information sheets to each student (information sheets are included in this lesson). Tell the students that they are going to play a game in which they will need to become familiar with these symbols.
2. Pass out copies of the map of the United States (included in the lesson) and ask the students to take a few minutes and review the map.
3. Divide the class into four or five teams and give each group a small bell. Explain that you will be asking several questions about the map. Questions are included in the lesson.
4. Assign one person in each team to be the team speaker. Tell the students that when you ask a question they must quietly discuss the answer as a team. When an answer is agreed upon the speaker can ring the team's bell. The first speaker to ring gets the chance to answer the question for his/her team. The teacher may want to change the speaker after every question or two to give everyone a chance to speak.
5. A correct answer wins 10 points for the team and a wrong answer means the team loses 5 points.
6. The team with the most points at the end of the game wins.

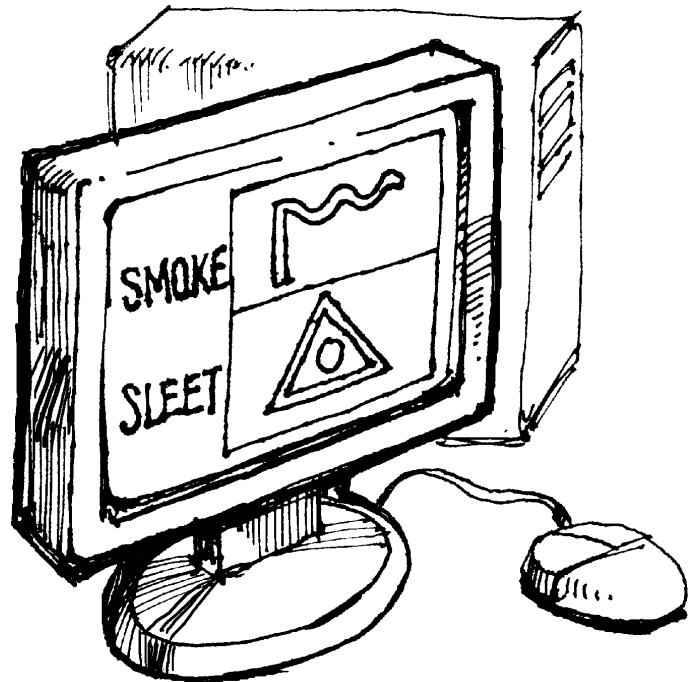
**CLOSURE:** Meteorologists play an important part in all

of our lives. With today's technology these professionals have saved hundreds of lives. They are able to predict dangerous storms, warn wildland fire fighters to abandon dangerous situations, and even assist the farmers in our area to choose the best time to plant and harvest their crops.

**EVALUATION:** The teacher is able to evaluate the students by the answers given during class participation and by how well they are able to read their maps.

## EXTENSIONS:

1. The students can design their own symbols for the following weather events: rain, lightning, tornado, snow, fog.
2. Students can research all the weather symbols on the internet or in the school library. This information can be used to make a poster to display in the classroom.
3. Invite a local TV weather person to speak to the class about different professions related to weather.



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## WEATHER SYMBOLS



Barometer Rising



Barometer Falling

### Precipitation Event

(Symbol)

### Intensity

Light

Moderate

Heavy

*Rain*



*Snow*



*Drizzle*



Warm Front



Cold Front



Cirrus Clouds



Cumulus Clouds



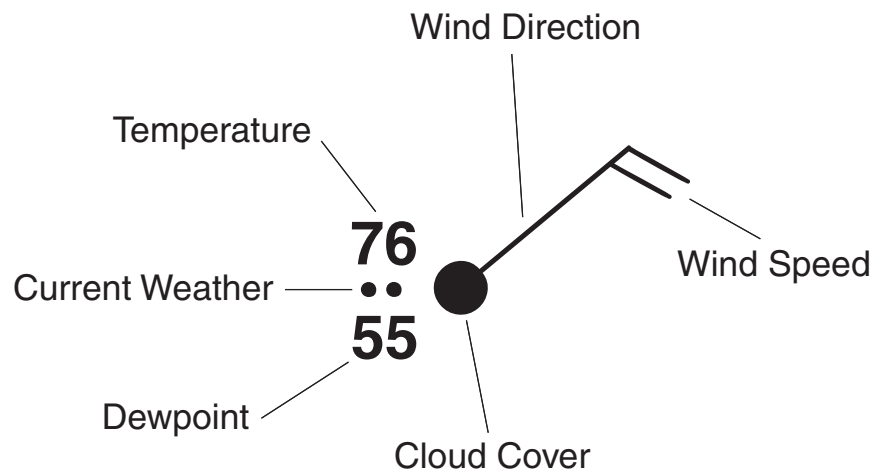
Hurricane

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## STATION MODEL

A *station model* shows where the weather station is located and has all the weather data surrounding it. In the following station plot the temperature is 76°F, the dewpoint is 55°F, and the wind direction is northeast at about 20 knots. The cloud cover is overcast and it is raining. Students will find a station model on the map in this lesson and will need to interpret what it means in relationship to fighting wildfires.

The flag-like symbol is called a *wind barb* and points in the direction from which the wind is blowing. Cloud cover is shown in the circle at the base of the wind barb. The wind speed is indicated by the markings on the wind barb. Do you see a pattern in the map?



### Cloud Cover



Clear



One  
Quarter



One  
Half



Three  
Quarters



Completely  
Overcast

### Wind Speed & Direction

1 Knot = 1.15 miles per hour



Calm



5  
Knots



10  
Knots



15  
Knots



20  
Knots



50  
Knots



60  
Knots

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## QUESTIONS

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1. Is the barometer rising, falling, or steady in Louisville, Kentucky? [falling]
2. Where is the heaviest rain in the United States? [Texas]
3. In which state(s) is it drizzling? [Washington, Louisiana, New York]
4. Which state(s) would be most dangerous for fire fighters to attempt to suppress a wild-fire? Why? [Utah, Wyoming, Colorado because each of these states has reasonably high temperatures, low dew point, winds 20-25 knots]
5. What is the wind direction, wind speed, temperature, dew point, and cloud cover in Los Angeles, California? [Wind direction is southeast, wind speed is 15 knots, temperature is 75 degrees, dew point is 50 degrees, and cloud cover is clear]
6. Which states have cumulus clouds in the sky? [Oklahoma, Arkansas, Missouri and Alabama]
7. What is the cloud cover over New Orleans, Louisiana? [Completely overcast]
8. Is the barometer rising or falling over New York City? [falling]
9. A warm front is passing through which state(s)? [Nevada, Utah, Wyoming, Colorado]
10. What is happening in Montana that will be beneficial to wildland fire fighters? [Heavy snow, light wind at 5 knots and dew point and temperature are the same (35) which indicates the air is completely saturated]
11. What is the cloud cover over Olympia, Washington? [ $\frac{3}{4}$  overcast]
12. What kind of storm might soon reach Miami, Florida? [A hurricane]
13. Over which city can you see cirrus clouds, Austin, Texas or Nashville, Tennessee? [Austin, Texas]
14. Is the barometer rising or falling over Minneapolis, Minnesota? [rising]
15. Which city in the southern part of the United States is completely overcast, receiving moderate rain and 30 knot winds? Hint: This city is the capital of this state. [Atlanta, Georgia]
16. A cold front is passing through which state(s)? [California, Kansas, Missouri, Illinois, Kentucky, Virginia, Maryland, Pennsylvania, and New York.]

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## WEATHER MAP

